

Job Number 8344
 Number Run 10600
 By E.M.
 Date 8-11-43

The Role of the Emergency Medical Service in Gas Defense *

W. P. DEARING, M. D., Senior Surgeon, U. S. Public Health Service

Assistant Chief Medical Officer, U. S. Office of Civilian Defense

Washington 25, D. C.

Gas has not been used in this war in any widespread fashion or against any of our English-speaking allies, even though the Japanese have employed it repeatedly against China, and Italy used it earlier against Ethiopia. We must never forget, however, that we are fighting a terrible, dangerous enemy who does not mean to lose this war and will use any means to achieve his end.

Pound for pound, high explosive is more destructive than war gas. Against the unenlightened, undisciplined, and unprotected population, however, the panic and confusion that gas warfare would produce may tempt the enemy to use it. Speculation as to what the enemy will do is dangerous and prediction has been largely futile. It is, after all, the enemy who will decide when and where he will use gas. We do know that he has technical equipment capable of bringing the war to this continent, and he could already have wreaked a certain amount of destruction on a few areas. It is quite probable that he has been deterred only by the knowledge that an immediate tightening of our own defenses would result. He prefers that we be lulled into inaction until he is ready to loose a sudden massive attack which can have the maximum effect on our war effort. We must plan and organize and train; we must be ready.

CIVILIAN DEFENSE ORGANIZATION

The Office of Civilian Defense was established by the President to organize and mobilize the civilian population of the country in defense against total war. Working through State and local governments, a volunteer army of over five million civilians is being organized and trained to serve in the U. S. Citizens Defense Corps—after the Army and Navy, the third arm of our national defense. In fact, the British, under the stress of actual aerial attack, have found that the civilian defense organization is of importance equal to that of the military forces in defending the country and its people.

In order to work very closely with the Army in the present planning stage and in all future operating stages, the Office of Civilian Defense has established regions coterminous with the Army Service Commands, with a field office in each. The national and regional staffs of the Office of Civilian Defense provide technical advice and assistance to State and local governments in all non-military phases of protection, including emergency medical service and gas defense. The Army looks to the Office of Civilian Defense to mobilize the civilian population in defense of the country in event of actual enemy

attack and to coordinate the civilian effort with military needs.

Never forget, however, that the backbone of civilian defense is the local community and its own people and institutions—the police, the fire department, the hospitals, the doctors and nurses. Upon the excellence of the preparations in each community will depend the capacity of that community to care for its citizens in an emergency.

A PRACTICAL APPROACH TO THE GAS PROBLEM

In developing a sane approach to the problem of gas defense, we must realize first that if gas is used there will be casualties. Perfect protection is not possible, even for soldiers. Matériel shortages preclude the distribution of everything necessary to protect every individual in every situation to which he might possibly be exposed, even if it were possible to teach everyone how to use the equipment. Soldiers require hours of training and continued practice to maintain good gas discipline, but with the best training and equipment, casualties occur. Even a gas mask must be worn correctly, and it may prove an actual hazard to one unskilled in its use because of the false sense of security it may engender. Compare the problem of the disciplined soldier who spends weeks learning to use his protective equipment with that of the busy housewife, and you will realize that procedures and equipment required for her protection are different. *Avoid exposure; stay indoors; go to a previously prepared gas-tight room.* These are the keynotes of protection for the general population.

Physicians are in a particularly good position to lead in developing a sane attitude toward gas defense. It is important to recognize that gas defense is a quantitative problem and not an "all or none" phenomenon. Some hospital administrators have the idea that if one patient with a drop of mustard on him is admitted to a ward, all the personnel will be burned and all the patients will eventually die of bronchopneumonia. I know of three officers who were inspecting a tiny vial of mustard used for skin sensitivity tests. They accidentally spilled one drop, which ran down the outside of the bottle. The odor of mustard soon became apparent in the room, and the group made a hasty exit. Then they sent a sergeant in to open a window!

This type of thinking must be changed. There are limits of tolerance, methods of improvising temporary protection, possible compromises, and simple, effective prophylaxis which permit us to protect ourselves if we understand the principles of gas defense. The concentration of gas in the air determines the intensity and rapidity of the effects produced. The lower the concen-

*Presented at American College of Surgeons War Sessions, March and April 1943. Published, Bulletin, American College of Surgeons, June 1943, Volume 28, Number 2.

tration, the longer is the period of exposure required to produce a casualty. We do not die from looking at a gas cloud 100 yards away.

If it becomes necessary as a result of fire or other destruction for inhabitants to leave their homes after a gas raid and be conducted through a contaminated area, safe lanes can be improvised by covering with planks, sand, sawdust, or in the winter, snow. Overshoes, rubbers, or even old rags will protect shoes and feet for a time while gloves and a rubberized or other overcoat or a skiing outfit will protect the hands and body. Any material covering will reduce exposure, and impervious garments such as cellophane capes, raincoats, and slickers will furnish considerable protection. Our goal is to minimize the effects of any attack that may occur.

COMMUNITY ORGANIZATION

The problem of organizing and training a community for gas defense may be divided into three parts:

- (1) Technical organization and training (nonmedical),
- (2) medical, including protection of hospitals by cleansing stations, (3) education of the general public.

TECHNICAL ORGANIZATION

In a community the backbone of the technical organization for gas defense is the Senior Gas Officer. He is a qualified chemist, perhaps from industry. He is appointed by the defense council of the city government. He has been trained in a Gas Specialist Course in a War Department Civilian Protection School. These are schools established and operated by the War Department in collaboration with the Office of Civilian Defense to give instruction in certain technical phases of protection. The Gas Specialist Course includes instruction in the mode of action of chemical warfare agents, in their detection in air, soil, food, and water, in methods of decontamination, and in the organization of a community for gas defense. The Senior Gas Officer must be prepared to assist the police and fire departments, the wardens, and other emergency services, including the Emergency Medical Service, in the steps they must take if war gas is used.

He needs a staff of trained assistants—first and most important, the gas reconnaissance agents, who are trained and equipped to determine by chemical means the nature and extent of any war gas contamination. They are called upon frequently in England today because of the many unusual smells from refrigerants, explosives, and other agents spread about by the bombing.

He will also need a laundry officer. Clothes are a serious problem. Some will have to be destroyed. Careful supervision of the decontamination of clothing is essential to prevent unnecessary loss.

The actual decontamination of areas will be done by street-cleaning departments and by the decontamination squads of the Citizens Defense Corps, but the Senior Gas Officer is the expert supervisor. He will also serve as technical consultant to the Chief of Emergency Medical Service.

MEDICAL ORGANIZATION

The training and organization of doctors and hospitals to care for gas casualties is the second consideration in preparing a community for gas defense.

The Chief of the Emergency Medical Service is responsible for the organization and emergency operation of all the medical facilities of the community. This includes seeing that physicians are instructed in the treatment of gas casualties and that hospitals are prepared to take the steps necessary to protect themselves and the hospital population against injury from the admission of contaminated patients.

Physicians may be summoned from so-called "protected interior" locations to help care for an emergency on our target seacoasts. Transportation of chemical agents may result in accidental exposures anywhere in the country. Every physician in the country, therefore, should understand the mode of action of chemical agents and the treatment of gas casualties, even though his community may not be subject to attack.

The general principles are fairly simple, although many chemical-warfare agents have been developed. More will be developed, and old ones will be used in new ways or combinations, but the endless detail about each agent is not pertinent to our problem. There has been too much said about geraniums, apple blossoms, sour fruit, and garlic. The mass of pharmacologic and toxicologic detail is interesting but of little practical importance to the general practitioner.

We must think rather in terms of time, namely, persistent and nonpersistent agents, and in terms of effects, the lung irritants, the skin and eye irritants, nose irritants, and the systemic poisons. There is some overlapping between these groups. For example, skin irritants in sufficient quantity prove to be systemic poisons or may even cause death from pulmonary effects. The usual effects from field concentrations, however, are indicated by the foregoing classification.

With cooperation of the Committee on Treatment of Gas Casualties of the National Research Council, we have conducted special courses for instructors at selected medical schools over the country. These courses cover in some detail the chemistry, pathologic physiology, and pharmacology of the important agents and the treatment of injuries therefrom. The organization of the community for gas defense is described, and an outline syllabus of a 6-hour course of instruction for general practitioners is presented.

This 6-hour course presents in an empiric but rather complete fashion the essential information that will enable any physician to understand and to care for the ordinary gas casualty. Most medical schools have agreed to make available the services of their faculties to give this instruction to physicians, and the Emergency Medical Service in cooperation with medical societies is handling administrative arrangements, schedules, publicity, and the meeting of expenses. To secure geographic coverage, it is often necessary for a team of instructors to go out from the medical school to points over a State where physicians can congregate. In some cases the State has underwritten the expenses of the team and in others a local community has done so. The instruction may be conveniently given in three 2-hour evening sessions, although some communities have found it desirable to present the entire course on a Sunday when more of the doctors are free to come in.

Gas Cleansing

Hospital administrators have special problems. They must plan for the provision of cleansing stations for injured patients who are also contaminated. The early thinking was that public or mass cleansing facilities should be provided for the entire population, and the British proceeded to construct facilities on that basis. They now regret that they spent \$50,000,000 on this program, and we all have come to recognize that it is quite impracticable. Liquid contamination must be removed within 5 minutes to prevent burns, and unless a cleansing facility could provide sufficient showers for every contaminated person in the neighborhood to bathe simultaneously, it would be ineffective and would only invite confusion and panic. Uninjured individuals must, therefore, cleanse themselves at the nearest hydrant, while injured persons who are unable to cleanse themselves should be cleansed at facilities provided at hospitals. Of course, industrial plants which have large numbers of workmen on a shift must give thought to mass cleansing facilities, but that is a problem we will not go into here.

The term "cleansing" is reserved for human beings; "decontamination" is applied to buildings, equipment, streets, and areas.

The principles of cleansing or decontamination are simple. Chlorination, oxidation, and hydrolysis are the three important chemical processes which are available. Some agents are more susceptible to one process than to the others. Mustard, for example, is susceptible to chlorination and much less so to hydrolysis or oxidation; Lewisite is quite susceptible to oxidation or hydrolysis; nitrogen mustards are susceptible to hydrolysis but not to chlorination. Accurate identification of the agent is necessary, therefore, before extensive decontamination of streets and areas can be efficiently carried out.

For human cleansing, however, the sodium hypochlorite bleaches combine oxidizing, chlorinating, and hydrolyzing effects, making identification of the agent of less importance. Lacking bleach, a mild alkali, such as soap, sodium bicarbonate, or boric acid increases hydrolysis. Only mild agents such as boric acid or sodium bicarbonate solution can be used in eyes and nose.

The persistent agents are oily liquids, but mechanical removal is of much value, even in the absence of neutralizing materials. Blotting off the excess and thorough washing with soap and water are effective on the human skin. Organic solvents may also be used to remove agents from the human skin, but great care must be exercised that in the process they do not spread the agent to new areas.

Hospital Cleansing Stations

The hospital administrator must remember that his station is primarily for protection of his hospital. The time already elapsed makes it inevitable that most contaminated patients brought to his door will suffer burns. They must be cleansed primarily to protect the hospital and its personnel, and secondarily to minimize their own injuries from chemical agents.

The shortage of materials and the present state of the war make it inadvisable to construct new facilities for

cleansing. The hospital must plan to adapt already available facilities, using a minimum of equipment, second-hand if possible, to provide this service. In developing plans, the Medical Division of the Office of Civilian Defense has consulted with a number of hospitals, and in no case has it been impossible to find a suitable location that could be adapted quickly for cleansing purposes.

Certain principles may be set forth to indicate the type of planning necessary. Three adjacent rooms or spaces are desirable, one for undressing, one for cleansing, and one for transfer of patients to clean stretchers before admission to the hospital. In the small hospital, however, two rooms or even one will suffice. The clothing may be removed out of doors if necessary, and the third room may be simply a hospital corridor sufficiently separated from the partly contaminated cleansing room.

It is important in planning to remember that emergency resuscitation treatment for gravely injured patients must be available in or near the undressing room. These are patients with uncontrolled hemorrhage, avulsed limbs, etc., who might not survive the cleansing routine. They must be taken out of the line and given emergency treatment to control hemorrhage and to relieve shock by the administration of morphine and plasma before they are cleansed. The personnel giving this treatment will, of course, need adequate protective clothing.

The gas cleansing station must have a separate entrance which is away from regular ambulance entrances and vital parts of the hospital such as X-ray, operating rooms, kitchen, and laundry. If there is no door available, a window through which a stretcher can be passed may be used. A ramp may be constructed. The entrance should be located as close to a roadway as possible in order to eliminate stretcher carrying. Since a stretcher is 7½ feet long, stairways, sharp corners, and narrow corridors should be avoided.

The undressing and cleansing rooms should be equipped with functioning floor drains, floor grading which prevents spilling over into hallways, and hot and cold water connections. The cleansing room must have two doors (or one door and window) through which cleansed patients may move out on the way to the hospital without backtracking. Thus recontamination can be avoided. Hydrotherapy rooms, nurses' and internes' shower rooms are often found to be suitable, and in small hospitals, autopsy rooms.

Ventilation by an exhaust fan or large (20-inch) portable fan blowing out of the window is an important factor in undressing and treatment rooms. Bins must be provided in which to keep contaminated clothing. Shelves and cabinets are needed for supplies.

Space must be available so that patients can be transferred to clean stretchers. Since the patients are now clean, the corridor or any other space will do. From here the patient may go directly into the hospital and mingle with the other casualties. A movable rack for the soiled stretchers is essential, but caution must be exercised, since they may be only partially decontaminated.

An outdoor area adjacent to a steam-hose outlet should be provided for the decontamination of stretchers. Each stretcher is to be decontaminated by brushing both sides with slurry of chloride of lime (3 shovelfuls in 2 gallons of water) to wash off oily agent, then hosing with live

steam. After stretchers have dried, they may be used again in ambulances going out.

In general, the size of the facilities set aside for gas cleansing purposes should be determined by the casualty receiving capacity of the hospital. For each stretcher station in the cleansing room, the estimated capacity is 10 patients per hour. If it is assumed that the bulk of casualties will be delivered within a 2-hour period and that 50 percent will require gas cleansing, three-stretcher capacity in the cleansing room would be needed for a hospital with casualty receiving capacity of 120 beds. This would care for 60 gassed casualties at the rate of 30 per hour with 10 for each stretcher station.

EDUCATION OF THE GENERAL PUBLIC

Education of the general public is the third and by far the most important part of the problem. Gas is a relatively impotent weapon against a trained population. Its greatest effectiveness lies in its ability to cause panic rather than in its ability to cause casualties. It could be used effectively for this purpose by saboteurs.

Our objective in public instruction is to teach simple procedures which are the essence of protection, introducing few technical details and leaving as little as possible to the judgment of the individual. The average citizen cannot be expected to identify agents accurately in an emergency, and he should be taught only such procedures as have the widest application.

The keynote of public instruction is self-aid. Gas attack by airplane spray or small bombs may expose many persons within a short space of time. When we remember that liquid vesicants must be removed within 5 minutes or less to avoid serious burns, it is apparent that uninjured persons will protect themselves more effectively if they cleanse themselves at the nearest house, than if they delay long enough to reach any public facility.

The official instructions on what to do in a gas attack issued by the Office of Civilian Defense are as follows:

1. **STAY INDOORS.** A tightly closed room affords protection against gas. All windows and doors should be tightly shut, and cardboard or blankets soaked with water should be kept in readiness to cover and seal shattered windows. Choose a room on an upper floor if possible; most war gasses are heavier than air, although they may be carried up with air currents.

2. **IF CAUGHT OUTDOORS IN A GAS ATTACK, GET OUT OF THE AREA AT ONCE.** Look down and shield your eyes with your arm. Do not worry about any brief vapor exposure to which you may be subjected. The danger from this source is not great.

3. **PROMPT ACTION WILL AVOID SERIOUS EFFECTS.** If you know or suspect that you have gotten any of the gas on your person or clothing, do not go hunting for a casualty station or gas-cleansing station and expect someone else to help you. *Knock on the first door* you come to and do whatever is necessary for yourself. Self-aid is the quickest and safest way.

4. **THIS IS WHAT YOU SHOULD DO.** THIS ROUTINE SHOULD BE MEMORIZED SO IT WILL BE DONE AUTOMATICALLY IN AN EMERGENCY:

- a. Remove shoes and outer clothing and drop them outside the house in a covered can if available. Do not touch this clothing again except with sticks or gas-proof gloves. Do not cling to false modesty. To enter a house with contaminated clothing endangers everyone in it.

- b. Get to a bathroom, kitchen, or laundry room as fast as possible.

- c. If your eyes have been exposed to liquid gas or spray, flush them immediately. Plain water out of a faucet, shower-head, canteen, or douche bag will do, but a lukewarm dilute solution of bicarbonate of soda (heaping tablespoonsful in a quart of water) is even better, if it is handy. Let anyone nearby help you.

- d. If drops of liquid blister gas have splashed the skin, you can prevent serious burns by adequate cleansing. Promptly blot up the liquid with pieces of cleansing tissue, cloth, or a handkerchief, which should be disposed of carefully so that it cannot contaminate anyone else. Then sponge the skin briskly with laundry bleach containing sodium hypochlorite, if it is at hand, and rinse off under the shower or in a tub. A thorough bath with a vigorous lathering is the final step which should never be omitted. Dry the skin by patting. Do not rub. Dress in whatever clean clothing you can get. If blisters develop, you should seek medical advice.

- e. If your nose and throat feel irritated, snuff and gargle with a dilute solution of bicarbonate of soda. If your chest feels heavy and oppressed, if you have any trouble breathing, or if smoking becomes distasteful, lie down immediately and stay perfectly still until you can be taken to a doctor. Do this even if you feel fine otherwise.

5. **REMEMBER:** Cleanse yourself quickly and calmly. FOLLOW THE INSTRUCTIONS OF YOUR AIR RAID WARDEN, and wait until he tells you it is safe to come out.

SUMMARY

1. The danger of gas attack on our civilian population is present, and our best defense is to plan, organize, and train.

2. The technical gas defense organization of the community must be established by the Senior Gas Officer under the U. S. Citizens Defense Corps.

3. The public must be educated in the principles of self-protection and self-aid.

4. Physicians should learn the principles of the mode of action of chemical warfare agents and treatment of gas casualties. Instruction is available through medical schools cooperating with the Emergency Medical Service.

5. Hospital administrators must plan to establish cleansing facilities for injured patients who are contaminated. Services of the Chief of Emergency Medical Service and the Senior Gas Officer are available to assist in such planning.

6. A sane approach to the gas-defense problem will minimize the effects of any gas attacks that may occur.